COMMUNICATIONS TO THE EDITOR

THE ABSORPTION OF WATER VAPOR BY COTTON CELLULOSE

Sir:

In a paper by L. M. Pidgeon and O. Maass entitled "The Adsorption of Water by Wood" [THIS JOURNAL, **52**, 1053 (1930)], figures are given for the adsorption of water vapor by purified cotton cellulose. The method of measurement was one that was selected by the authors after a consideration of the possible sources of error, since, they say, "Little of the work which has been done is entirely free from objection . . . . and . . . . in even the most careful determinations of the adsorption by cotton cellulose the amount of adsorption was measured indirectly."

The absorption of water vapor by cotton has formed the subject of systematic investigations extending over eight years by my colleagues, the late Dr. A. M. Williams and Dr. A. R. Urquhart. The methods used were submitted to critical examination, and the results of the investigation, which derive from observations on some hundreds of samples of cotton, are contained in the *Shirley Institute Memoirs*, and are being published in a series of communications to the "Journal of the Textile Institute," nine of which have so far appeared since 1924. A complete absorption and desorption isotherm for pure cotton cellulose at 25° is given in one of these communications [*J. Text. Inst.*, **15**, T433 (1924), or *Shirley Institute Memoirs*, **3**, 197 (1924)], the latter of these two references being quoted by Pidgeon and Maass in their paper.

Since these authors have omitted to do so, and since the *Shirley Institute Memoirs* do not possess the wide circulation among scientific readers enjoyed by the *Journal of the American Chemical Society*, it seems desirable to call the attention of your readers to the fact that, at high relative humidities, there are gross discrepancies between the results of Pidgeon and Maass and those of Urquhart and Williams. Only one isotherm is given by Pidgeon and Maass, namely, at 23°, but this can be compared with the isotherm obtained by Urquhart and Williams at 25°, since it is clear from the work of both laboratories that this small difference of temperature can have no significant effect on the moisture absorption at a given relative humidity. The value obtained by Urquhart and Williams exceeds that given by Pidgeon and Maass by 11% at saturation, by 4% at 90% relative humidity, and by 2% at 80% relative humidity.

It is to be hoped that an attempt will be made to discover the source of the discrepancy, which must lie either in the technique of measurement or in the samples of "pure cotton cellulose." In this connection, it must be pointed out that the chemical attack of cotton cellulose by bleaching or otherwise, which increases its solubility in sodium hydroxide solutions, or reduces its so-called "α-cellulose" content, does not increase its moisture

absorption at constant humidity, as Pidgeon and Maass would appear to expect on theoretical considerations, but has the opposite effect.

From the purely scientific aspect, the absolute values of the absorption may appear of less importance, as any errors of technique affecting all measurements would not necessarily invalidate conclusions drawn from the comparative behavior of different materials. Absolute values of the moisture absorption of cotton are, however, of the highest commercial and technical importance, since cotton is bought and sold on an agreed average moisture content, which can be defined from the absorption isotherm when the average conditions with respect to humidity and temperature are known. From this point of view alone it seems advisable to place on record the fact that the low figures of Pidgeon and Maass at high humidities—which will certainly surprise many technical workers experienced in the cotton processing industries—are much below those of other workers who have also devoted themselves to a long and critical examination of the subject.

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THE SUPERPOSITION OF ELECTRON CHARGES IN MOLECULES AND α-PARTICLES

Sir:

In their paper on the hydrogen molecule, Heitler and London[1] went to great length to stress the fact that the valence forces were not the ordinary coulomb forces, but were due to an exchange phenomenon involving the pair of electrons. Recent work by Slater,[2] Zener,[3] Bartlett[4] and others, raises the question as to whether Heitler and London have not over-emphasized the importance of the exchange phenomenon. When we consider the exchange phenomenon we find that it has little objective significance; it may be described as a resonance effect in wave functions. On the other hand, the work of Slater and the others referred to above makes it clear that the bonding force between atoms is due to the over-lapping or superposition of electron charge, the electron charge being treated as a distributed charge, whose density is proportion to $\psi\bar{\psi}$. In atoms with more than one valence electron, where the charge distribution is not spherically symmetrical, there is the possibility of a considerable

[1] Heitler and London, *Z. Physik*, **44**, 455 (1927).
[2] Slater, *Phys. Rev.*, **36**, 57 (1930).
[3] Zener, *ibid.*, **36**, 51 (1930).
[4] Bartlett, *ibid.*, **36**, 1096 (1930).